



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE HETEROGONY OF *OXALIS VIOLACEA*.

BY WILLIAM TRELEASE.

IN May of the present year, after collecting specimens of the violet wood-sorrel about Madison, Wis., I noticed that I had succeeded in getting two well-marked forms of flowers, in one of which the pistils were considerably longer than the stamens, which were in two sets of slightly different length, while in the other the pistils were shorter than either set of stamens. On the supposition that these were respectively the long-styled and short-styled forms of a trimorphic species, careful search was made for the mid-styled form. In a class exercise in analysis, something over one hundred plants were studied, but only the two forms above mentioned were found, and in nearly equal num-

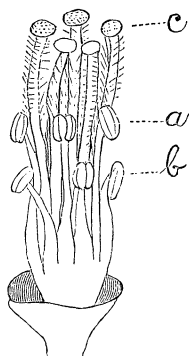


FIG. 1.

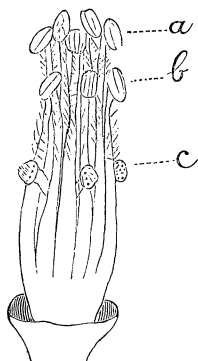


FIG. 2.

FIG. 1.—Long-styled flower of *Oxalis violacea*. FIG. 2.—Short-styled flower of the same species. Magnified eight diameters.

bers. An examination, made by myself, of the flowers of about a hundred additional plants, from different localities within an area of a few miles, gave a similar result.

Up to this time no accurate record of the number of plants of either form, or of the absolute lengths of stamens and pistils had been made, attention having been given only to the presence or absence of mid-styled flowers, and, in a general way, to the relative abundance of the two forms which were found. After this eighty-one flowers, gathered at random from as many plants, were carefully examined, and it was found that in fifty-one the styles were nearly twice as long as the average of both sets of stamens, while the styles of the remaining thirty were shorter than either

set of stamens, the latter being about equal to the pistils of the long-styled flowers. These forms are represented in Figs. 1 and 2. The measurements of the flowers referred to, are given in the following tables:

TABLE I.—OXALIS VIOLACEA.

<i>Measurements of Stamens and Pistils from Long-styled Flowers.</i>			
Flower Numbers.	Pistils.	Long Stamens.	Short Stamens.
1.....	5. mm.	3.2 mm.	2.5 mm.
2.....	4.5 "	2.8 "	2. "
3.....	4.6 "	3. "	2.2 "
4.....	4.8 "	2.8 "	2. "
5.....	4.4 "	3. "	2. "
6.....	4. "	2.8 "	2. "
7.....	5.6 "	3.5 "	2.6 "
8.....	4.8 "	2.6 "	1.8 "
9.....	4.8 "	3. "	2.5 "
10.....	4.5 "	3. "	2. "
11.....	5. "	3. "	2. "
12.....	4. "	2.4 "	1.8 "
13.....	4.6 "	3. "	2. "
14.....	4.6 "	2.5 "	2. "
15.....	4.8 "	3. "	2. "
16.....	4.2 "	3. "	2. "
17.....	4.6 "	2.8 "	2. "
18.....	4. "	2.2 "	1.6 "
19.....	5. "	3. "	2. "
20.....	4. "	2.8 "	2. "
21.....	4.4 "	2.3 "	1.6 "
22.....	4.4 "	2.5 "	2. "
23.....	4.2 "	2.4 "	1.8 "
24.....	4.2 "	2.5 "	2. "
25.....	4.8 "	2.8 "	2. "
26.....	5. "	3. "	2. "
27.....	4.6 "	2.8 "	2. "
28.....	5. "	3. "	2.5 "
29.....	4. "	3. "	2. "
30.....	4.8 "	3. "	2. "
31.....	4.6 "	3. "	2. "
32.....	5. "	3. "	2. "
33.....	5. "	3. "	2. "
34.....	4.8 "	2.8 "	2. "
35.....	4.8 "	3. "	2. "
36.....	4.4 "	2.8 "	2. "
37.....	5.1 "	3. "	2. "
38.....	4.4 "	2.5 "	2. "
39.....	5. "	3. "	2. "
40.....	5. "	3.2 "	2.4 "
41.....	4. "	2.5 "	2. "
42.....	4. "	2.8 "	2. "
43.....	4. "	2.8 "	2. "
44.....	4.8 "	2.8 "	2. "
45.....	4.5 "	3. "	2. "
46.....	4.2 "	2.8 "	2. "
47.....	4.5 "	3. "	2. "
48.....	4.6 "	2.6 "	2. "
49.....	4.8 "	3. "	2. "
50.....	5. "	3. "	2. "
51.....	4. "	2.5 "	2. "

TABLE II.—OXALIS VIOLACEA.

<i>Measurements of Stamens and Pistils from Short styled Flowers.</i>			
Flower Numbers.	Pistils.	Long Stamens.	Short Stamens.
1.....	3. mm.	5.1 mm.	4. mm.
2.....	3. "	5.1 "	4. "
3.....	2.4 "	5. "	4. "
4.....	2.3 "	5. "	4. "
5.....	2.5 "	4.2 "	3. "
6.....	2.5 "	5. "	4. "
7.....	2.5 "	5. "	4. "
8.....	2.5 "	4.8 "	3.6 "
9.....	2.4 "	5. "	4. "
10.....	2.5 "	5.4 "	4. "
11.....	2.4 "	5.4 "	4. "
12.....	2.4 "	5. "	4. "
13.....	2.8 "	5.1 "	4. "
14.....	2. "	4.5 "	3.2 "
15.....	3. "	5. "	4. "
16.....	2.5 "	4.8 "	3.8 "
17.....	2. "	5. "	3.8 "
18.....	2.5 "	5. "	4. "
19.....	2.5 "	4.8 "	3.5 "
20.....	2.5 "	5. "	4. "
21.....	3. "	5.5 "	4.5 "
22.....	2. "	4.6 "	3.2 "
23.....	2.4 "	4.6 "	3.8 "
24.....	2.6 "	5. "	4. "
25.....	2. "	5.5 "	4.2 "
26.....	2.4 "	5. "	4. "
27.....	2.5 "	5. "	4. "
28.....	2.5 "	5. "	4. "
29.....	2. "	4. "	3. "
30.....	2.4 "	5. "	4. "

Though both stamens and pistils vary in length, as might, indeed, be expected from the fact that the flowers are by no means of uniform size, a glance at the tables and appended diagram shows that, as a rule, the styles of either form are intermediate in length between the two sets of stamens belonging to the other form; while the difference between the stigmas and the nearest set of anthers is, in either, greater than that between the stamens themselves, both differences being nearly constant for both long and short-styled flowers.

This is slightly different from the usual arrangement of the parts in trimorphic species, as may be seen by comparing Figs. 1 and 2, representing the species under consideration, with Figs. 3, 4 and 5, after Hildebrand, representing the trimorphic *O. gracilis*. That the long stamens of the long-styled flowers, and the short stamens of the short-styled flowers stand at different heights—as may be most clearly seen by comparing the lines *a* and *b'* in the diagram—and not at the same height, is, it seems to me, of

some importance. In trimorphic plants too, the pollen grains from the two sets of stamens of a given flower commonly differ

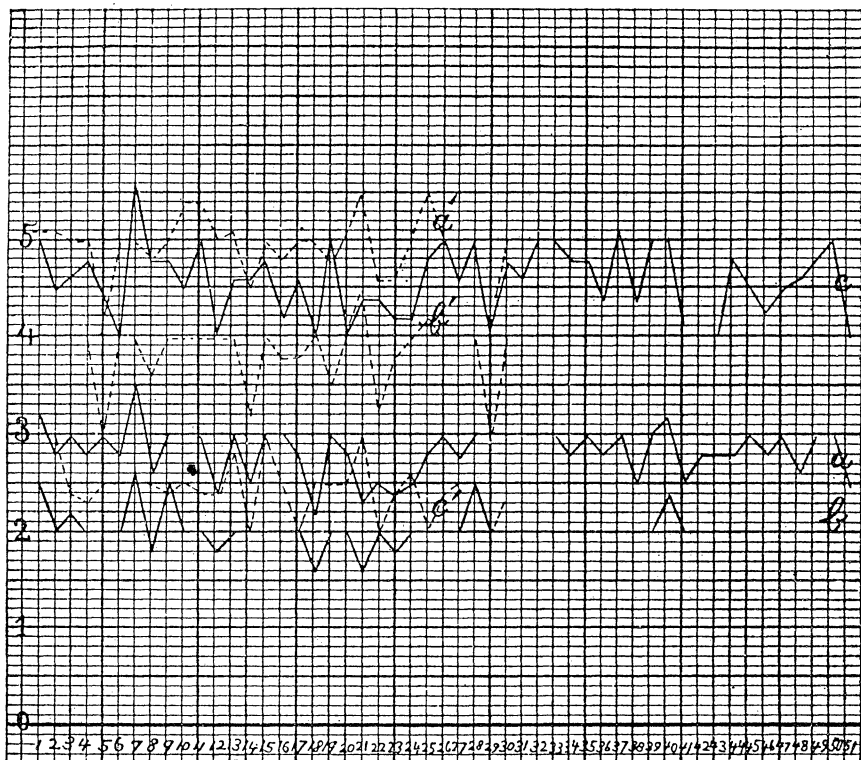


Diagram showing the relative lengths of stamens and pistils in eighty-one flowers of *Oxalis violacea*; from Tables I and II. The unbroken lines connect coordinates representing measurements of long-styled flowers; the dotted lines connect those for short-styled flowers. *a*, the long stamens; *b*, the short stamens; *c*, the styles. The heavy line marked *o* represents the base of the corolla; the other transverse lines representing millimeters and fractions.

noticeably in size, but the following measurements of pollen from three flowers of each sort do not show this difference:

TABLE III.—*OXALIS VIOLACEA*.

Measurements of Pollen from Long-styled Flowers.		
Flower Numbers	Long Stamens.	Short Stamens.
1.....	44 μ . \times 24 μ .	44 μ . \times 24 μ .
2.....	44 " \times 24 "	44 " \times 24 "
3.....	44 " \times 24 "	40 " \times 24 "

TABLE IV.—*OXALIS VIOLACEA*.

<i>Measurements of Pollen from Short styled Flowers.</i>		
Flower Numbers.	Long Stamens.	Short Stamens.
1.....	50 μ . \times 28 μ .	48 μ . \times 27 μ .
2.....	50 " \times 28 "	52 " \times 34 "
3.....	52 " \times 32 "	48 " \times 28 "

These grains were measured dry, immediately after removal from newly gathered flowers. It will be seen that those from both sets of stamens in any flower, are nearly equal in diameter; while, as is usual in heterogonous plants, those from the short-styled flowers are larger than those from the long-styled.

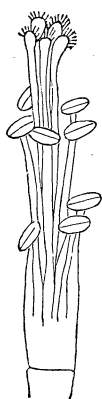


FIG. 3.

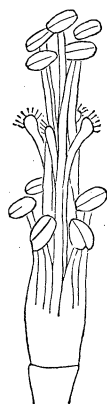


FIG. 4.

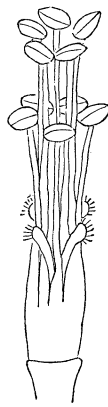


FIG. 5.

FIG. 3.—Long-styled flower of *O. gracilis*. FIG. 4.—Mid-styled flower of the same. FIG. 5.—Short-styled flower of the same. The calyx and corolla have been removed in every case.

The facts indicated appear, so far as they go, to point to dimorphism rather than trimorphism in this species; although with truly trimorphic plants, one or even two of the forms may occasionally be absent from a given district. Concerning the local occurrence of but two forms of trimorphic plants, Mr. Darwin¹ says: "Fritz Müller formerly believed that a species of *Oxalis*, which is so abundant in St. Catharina that it borders the roads for miles, was dimorphic instead of trimorphic. Although the pistils and stamens vary greatly in length, as was evident in some specimens sent to me, yet the plants can be divided into two sets, according to the lengths of these organs. A large pro-

¹ Different Forms of Flowers on Plants of the same Species, p. 180.

portion of the anthers are of a white color and quite destitute of pollen; others which are pale yellow contain many bad with some good grains; and others again which are bright yellow have apparently sound pollen; but he has never succeeded in finding any fruit on this species. The stamens in some of the flowers are partially converted into petals. Fritz Müller after reading my description * * * of the illegitimate offspring of various heterostyled species, suspects that these plants of *Oxalis* may be the variable and sterile offspring of a single form of some trimorphic species, perhaps accidentally introduced into the district, which has since been propagated asexually." A case somewhat similar to that of *Oxalis violacea* about Madison, is afforded by a Brazilian species of *Pontederia*, of which Fritz Müller¹ found only long and short-styled flowers. An important difference, however, is found in the measurements of the pollen from the different sets of stamens of a given flower; for "the pollen grains distended with water from the longer stamens of the short-styled form are to those from the shorter stamens of the same form as 100 to 87 in diameter, as deduced from ten measurements of each kind. * * * Moreover, the longer stamens of the long-styled form of *Pontederia*, and the shorter ones of the short-styled form are placed in a proper position for fertilizing the stigma of a mid-styled form."

"With respect to the absence of the mid-styled form in the case of the *Pontederia* which grows wild in Southern Brazil," Mr. Darwin adds, "this would probably follow if only two forms had been originally introduced there; for, as we shall hereafter see from the observations of Hildebrand, Fritz Müller and myself, when one form of *Oxalis* is fertilized exclusively by either of the other two forms, the offspring generally belong to the two parent-forms."²

Whether in *O. violacea* we are dealing with a case of this sort, or whether the species is dimorphic, can only be definitely decided by the examination of many specimens collected over as large a range of territory as possible, and it is to be hoped that those who have the opportunity will make observations of this sort. Meantime it seems not improbable that the plant is dimorphic; and although dimorphic species are as yet unknown in this genus,

¹ Jenaische Zeitschr., VI, 1871, p. 74, fide Darwin. l. c., p. 184.

² l. c., p. 185. cf., also p. 212.

so far as I am aware, the occurrence of both homogone and trimorphic species gives some reason for looking for still others which are dimorphic. In writing this I am perfectly aware that Hildebrand¹ has examined a few herbarium specimens of *O. violacea*, finding eight long-styled, three short-styled, and one mid-styled plant in the twelve specimens examined. The constant lack of correspondence in our specimens between the sets of stamens which should correspond, however, leads one to wonder if a mistake may not have been made, especially since a slight discrepancy exists between the numbers cited and the summary, in the paragraph cited.

Both the long and short-styled flowers are visited by small bees in considerable numbers, the more common being *Nomada bisignata*, *Ceratina dupla*, *Augochlora pura*, an *Osmia*, and several species of *Halictus*. These insects are attracted by the nectar which is secreted, apparently, by the papillose bases of the petals, and which is protected from rain, &c., by pubescence on the styles in the long-styled flowers, and on the filaments in the other form. As a result of these visits, some flowers of both kinds produce capsules, which are by no means uncommon, although by far the greater number fall away without bearing any fruit.

—:O:—

FORESTS—THEIR INFLUENCE UPON CLIMATE AND RAINFALL.

BY J. M. ANDERS, M.D., PH.D.

THAT there exists some sort of relation betwixt forests and conditions of climate, perhaps most observers would be ready to concede. Many attempts have been made to explain how forests affect atmospheric states, but there is great diversity of opinion on the subject, and, indeed, the question to-day remains somewhat involved in obscurity. As every one knows, there was a time when forests were considered almost inexhaustible. It is also a well-known fact that the destructive hand of man began, centuries ago, to fell rapidly these abundant forests, and changes of climate and fertility of the soil have, in numerous regions, been attributed solely to this denudation of the land. On examining the literature of the subject, it is found that the balance of

¹Monatsber. Berlin Akad., June 21, 1866, p. 357.